

REMARKS/ARGUMENT

Claims 1-20 are pending in the application. Claims 1-20 stand rejected.

Applicant would like to draw the Examiner's attention to the Office Action Summary, Item 13 stating that some certified copies of the priority documents have been received. However, in a communication from the PTO dated August 17, 2001, all required items are designated as received. Applicant requests clarification of which documents, if any, were not received.

Claims 1, 3, 10 and 12 are rejected under 35 U.S.C. § 102 in light of U.S. Patent No. 6,283,568 ("Horii"). Applicant respectfully traverses this rejection.

To anticipate a claim under 35 U.S.C. § 102, the cited reference must disclose every element of the claim, as arranged in the claim, and in sufficient detail to enable one skilled in the art to make and use the anticipated subject matter. See, PPG Industries, Inc. v. Guardian Industries Corp., 75 F.3d 1558, 1566 (Fed. Cir. 1996); C.R. Bard, Inc. v. M3 Sys., Inc., 157 F.3d 1340, 1349 (Fed. Cir. 1998). A reference that does not expressly disclose all of the elements of a claimed invention cannot anticipate unless all of the undisclosed elements are inherently present in the reference. See, Continental Can Co. USA v. Monsanto Co., 942 F.2d 1264, 1268 (Fed. Cir. 1991).

Among the limitations not present in Horii are:

selecting any one or none of said plurality of waveform signals for each of said plurality of nozzles according to gray scale information of printing data; and

applying voltage to corresponding piezoelectric actuators, while said plurality of drive waveform signals are selected and generated at the time of said scanning in the first direction so that dots with a plurality of gray scale values are generated, and said ink jet recording head is

moved in a second direction which is relatively orthogonal to said first direction concerning said recordable medium.

The present invention uses a device and structure capable of discharging ink droplets with different diameters at the same time. The explicitly recited structure provides for more ink droplets with different diameters being output, yielding higher print quality. Thus, a higher grey scale value in terms of dots and image quality results.

As recited in Applicant's claim, multiple drive wave forms are produced which, when scanned over a certain position, provide a plurality of dots per pixel. Thus, the drive wave formed for each scan can be switched resulting in multiple dots per pixel thereby yielding a higher resolution. Further, as explicitly recited in Applicant's claim, during each scan "one or none of said plurality of wave form signals" is selected for each of said plurality of nozzles. This further allows for greater flexibility when printing.

In contrast, Horii, while capable of generating a plurality of waveforms, is incapable of not applying a wave form to a specific nozzle. In other words, Horii does not disclose selecting none of the wave forms to be applied to a specific nozzle. Additionally, Horii applies to a device capable of outputting three kinds of drive wave forms, and switching selection during the discharge period. Thus, the device of Horii can have up to nine kinds of wave forms. This is in contrast to Applicant's device which is capable of outputting three kinds of drive wave forms and scanning a certain pixel position on a recording medium three times thus, providing nine kinds of dots. Therefore, the present invention is characterized by switching a set of driving wave forms for each scan.

Claim 1 is neither disclosed nor suggested by Horii and therefore it is asserted that independent claim 1 is patentable over Horii. Additionally, claims 2-9 include the limitations of claim 1 and include additional limitations which, in combination with the limitations of claim 1, are also not disclosed nor suggested in Horii. It is asserted that these

claims are patentable as well. Reconsideration of the rejection under 35 U.S.C. § 102 is respectfully requested.

Among the limitations of claim 10 that are neither disclosed nor suggested by Horii are:

control means for moving said ink jet recording head and selecting, for each of said plurality of nozzles, any one or none of the plurality of drive waveform signals; and

drive means for applying said drive waveform signals to said piezoelectric actuators by selecting none or one of a plurality of drive waveform signals output from said drive generating means said plurality of drive waveform signals are selected and generated at the time of said scanning in the first direction so that dots with a plurality of gray scale values are generated, and

As explicitly recited in claim 10, control means are used for moving the ink jet recording head and selecting any one of a plurality of drive wave form signals for each of the nozzles. Further, the drive wave form signals are selected and generated at the time of said scanning in the first direction so that dots with a plurality of grey scale values are generated.

This is unlike Horii which, although capable of generating a plurality of wave forms, is incapable of changing the wave forms as explicitly recited in Applicant's claim.

Claim 10 is neither disclosed nor suggested by Horii. Additionally, claims 11-20 include the limitations of claim 10 and include additional limitations, which, in combination with the limitations of claim 10, are neither disclosed nor suggested by Horii. Therefore, these claims are patentable as well. Reconsideration of the rejection under 35 U.S.C. § 102 is respectfully requested.

Claims 2, 4-7, 11, and 13-17 stand rejected under 35 U.S.C. § 103 as being

unpatentable over Horii in view of U.S. Patent No. 6,293,643 ("Shimada"). Applicant respectfully requests reconsideration of this rejection.

To establish a prima facie case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or combine references to arrive at the claimed subject matter. The prior art references must also teach or suggest all the limitations of the claim in question. See, M.P.E.P. § 706.02(j). A reference can only be used for what it clearly discloses or suggests. See, In re Hummer, 113 U.S.P.Q. 66 (C.C.P.A. 1957); In re Stencel, 4 U.S.P.Q.2d 1071, 1073 (Fed. Cir. 1987). Here, the references, whether taken individually or in combination, do not disclose or suggest the invention claimed by the Applicant.

The Shimada reference is included in the Office Action not to cure the deficiencies discussed above regarding Horii but to add additional limitations missing from the dependent claim in the primary reference. However, Shimada fails to cure the deficiencies in Horii discussed above.

Shimada does not disclose a plurality of wave form generating means nor does Shimada allow for the change of wave form during printing.

Thus, claims 2, 4-7, 11 and 13-17 are allowable over Horii in view of Shimada.

Claims 8, 9, and 18-20 are rejected under 35 U.S.C. § 103 as being unpatentable over Horii in view of Shimada and further in view of U.S. Patent No. 6,338,542 ("Fujimori"). As discussed above, Shimada fails to cure the deficiencies present in Horii and the addition of Fujimori also fails to cure those deficiencies discussed above. Fujimori periodically allows switching within a single scan in order to produce new printing modes. Specifically, three dot diameters are used two modes, which, in combination a

printing mode capable of outputting six types of dot diameters can be achieved. Thus, while a change of wave form can be had, the reference only has a single wave form generating means. Thus, the addition of Fujimori fails to cure the deficiencies discussed above. Thus, claims 8, 9 and 18-20 are patentable over the cited references.

Applicant has responded to all of the rejections and objections recited in the Office Action. Reconsideration and a Notice of Allowance for all of the pending claims are therefore respectfully requested.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

If the Examiner believes an interview would be of assistance, the Examiner is welcome to contact the undersigned at the number listed below.

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Respectfully submitted,

By 

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APPENDIX B
Version With Markings To Show Changes Made
37 CFR 1.121(b)(iii) AND (c)(ii)

CLAIMS (with indication of amended or new):

1. (Thrice Amended) An ink jet recording head driving method, the ink jet recording head having a plurality of nozzles and a plurality of pressure generating chambers and piezoelectric actuators corresponding thereto, said process comprising:

scanning said ink jet recording head in a first direction while simultaneously generating a plurality of drive waveform signals;

selecting for each of said plurality of nozzles any one or none of said plurality of drive waveform signals; and

applying said selected drive waveform signals to respective piezoelectric actuators corresponding to said plurality of nozzles said plurality of drive waveform signals are selected and generated at the time of said scanning in the first direction so that dots with a plurality of gray scale values are generated.

10. (Thrice Amended) An ink jet recording head driving circuit the ink jet recording head having a plurality of nozzles and a plurality of pressure generating chambers and corresponding piezoelectric actuators corresponding thereto, said ink jet recording head driving circuit in comprising:

recording means for recording drive waveform information for drive waveform signals;

waveform generating means for simultaneously generating a plurality of drive waveform signals based on said drive waveform information read from said recording means;

control means for moving said ink jet recording head and selecting, for each of said plurality of nozzles, any one or none of the plurality of drive waveform signals; and

drive means for applying said drive waveform signal to said piezoelectric actuators by selecting none or one of a plurality of drive waveform signals output from said drive

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generating means generated at the time of said scanning in the first direction so that dots with a plurality of gray scale values are generated.

APPENDIX C
“Clean” Version Without Amended/New Indications
37 CFR 1.121(c)(3)

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1. An ink jet recording head driving method, the ink jet recording head having a plurality of nozzles and a plurality of pressure generating chambers and piezoelectric actuators corresponding thereto, said process comprising:

- scanning said ink jet recording head in a first direction while simultaneously generating a plurality of drive waveform signals;
- selecting for each of said plurality of nozzles any one or none of said plurality of drive waveform signals; and
- applying said selected drive waveform signals to respective piezoelectric actuators corresponding to said plurality of nozzles said plurality of drive waveform signals are selected and generated at the time of said scanning in the first direction so that dots with a plurality of gray scale values are generated.

2. The ink jet recording head driving method according to claim 1, characterized in that at least one of said plurality of drive waveform signals is different from a drive waveform signal generated during a previously executed dot forming process.

3. The ink jet recording head driving method according to claim 1, characterized in that drive waveform signals for discharging ink droplets with a large jet amount of ink and drive waveform signals for discharging ink droplets with a small jet amount of ink are generated simultaneously.

4. The ink jet recording head driving method according to claim 1, characterized in that drive waveform signals for discharging ink droplets with a large jet amount of ink and drive waveform signals for discharging ink droplets with a small jet amount are alternately generated.

5. The ink jet recording head driving method claim 1, characterized in that said dot forming process is executed at least twice on a same place of said recording medium.

6. The ink jet recording head driving method according to claim 5, characterized in that during said dot forming process, nozzles that are positioned at a different place from the nozzles used during a previously executed dot forming process pass the place opposite the same place of said recording medium.

7. The ink jet recording head driving method according to claim 5, characterized in that during the dot forming process, nozzles which are positioned at the same place as the nozzles used during the previously executed dot forming process pass the place opposite the same place of said recording medium.

8. The ink jet recording head driving method according to claim 6, characterized in that the combination of drive waveform signals is determined on the basis of a number of times of said dot forming process is performed and the number of times the same or a different nozzles a nozzle passes the place opposite the same place of said recording medium.

9. The ink jet recording head driving method according to claim 8, characterized in that the number of times the dot forming process is performed is determined based on a high-speed printing mode that is for printing in a high-speed and a high-quality image mode.

10. An ink jet recording head driving circuit the ink jet recording head having a plurality of nozzles and a plurality of pressure generating chambers and corresponding piezoelectric actuators corresponding thereto, said ink jet recording head driving circuit in comprising:

recording means for recording drive waveform information for drive waveform signals;

waveform generating means for simultaneously generating a plurality of drive waveform signals based on said drive waveform information read from said recording means;

control means for moving said ink jet recording head and selecting, for each of said plurality of nozzles, any one or none of the plurality of drive waveform signals; and

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drive means for applying said drive waveform signal to said piezoelectric actuators by selecting none or one of a plurality of drive waveform signals output from said drive generating means generated at the time of said scanning in the first direction so that dots with a plurality of gray scale values are generated.

11. An ink jet recording head driving circuit according to claim 10, characterized in that said waveform generating means generates at least one drive waveform signal that is different from any of a plurality of drive waveform signals generated at a previous scanning of said ink jet recording head in said first direction.

12. An ink jet recording head driving circuit according to claim 10, characterized in that said waveform generating means simultaneously generates drive waveform signals for discharging ink droplets with a large amount of ink and drive waveforms for discharging ink droplets with a small amount of ink, in combination.

13. An ink jet recording head driving circuit according to claim 10, characterized in that said waveform generating means alternately generates a plurality of drive waveform signals for discharging ink droplets with a relatively large amount of ink and drive waveform signals for discharging a relatively small amount of ink at every scanning of said ink jet recording head in said first direction.

14. An ink jet recording head driving circuit according to claim 10, characterized in that said control means selects said drive waveform signals for execution at least two times in a same place of said recording medium.

15. The ink jet recording head driving circuit according to claim 14, characterized in that said control means makes nozzles, which are positioned at a different place from the nozzles used during the scanning of the ink jet recording head in the first direction, pass the place opposite the first place of said recording medium.

16. The ink jet recording head driving circuit according to claim 14, characterized in that said control means makes nozzles, which are positioned at the same place as the nozzles

used for scanning of said ink jet recording head in the first direction, pass the place opposite the same place of said recording medium.

17. The ink jet recording head driving circuit according to claim 15, characterized in that said control means selects said drive waveform signals on the basis of supplied data.

18. The ink jet recording head driving circuit according to claim 17, characterized in that a combination of drive waveform signals is determined on the basis of a number of times said ink jet recording head scans and a number of times a same or different nozzle passes a place opposite the same place of said recording medium.

19. The ink jet recording head driving circuit according to claim 18, characterized in that the number of times said ink jet recording head scans and the number of times whereof the same or different nozzle passes the place opposite and the same place of said recording medium is determined on the basis of a high-speed printing mode for printing a high-speed and a high-quality image.

20. The ink jet recording head driving circuit according to claim 15, characterized in that said control means determines a number of times said ink jet recording head scans in the first direction and a number of times same or a different nozzle passes the place opposite the same place of said recording medium on the basis of a high-speed printing mode, determines a combination of drive waveform signals selected and generates said waveform selecting data on the basis of the determined combination of said drive waveform signals.